Original article

Epidemiological and clinical aspects of urinary tract infection in community-dwelling elderly women

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ABSTRACT

Background: Urinary tract infections (UTIs) in elderly patients can be a complex problem in terms of approach to diagnosis, treatment, and prevention, because the patients often present nonspecific symptoms. The epidemiological and clinical characteristics of UTI in elderly women were studied, in order to make early diagnosis and prevent serious clinical complications secondary to UTI.

Methods: This was a prospective population-based study, with elderly women, during their first medical office visit. Medical records were obtained by clinical history and physical examination in order to detect signs and symptoms of UTI and the presence of co-morbidities. Clean-catch midstream urine specimens for urinary dipstick test, sediment, and culture were collected; cervical samples for conventional Pap smears were also collected.

Results: UTI was found in 16.55% of elderly women. The most frequent urinary symptom was foul smelling urine, in 60.6%. *E. coli* was responsible for 98 (76.56%) cases of significant bacteriuria; 34 (34.69%) were resistant to trimethoprim-sulfamethoxazole, and 21 (21.42%) to fluoroquinolones. Asymptomatic bacteriuria (AB) was not treated. The presence of predisposing factors demonstrated that the history of previous UTI ($p < 0.001$), vaginitis ($p < 0.001$), and diabetes ($p = 0.042$) increased the risk for UTI.

Conclusion: This study confirmed the high prevalence of UTI among elderly women and its unusual clinical presentation. Diabetes, history of previous UTI, and vaginitis were shown to be predisposing factors for UTI; it is not necessary to treat AB in elderly women, even among diabetics.

Introduction

The elderly population is increasing worldwide. In Brazil, the average female life is 71.3 years, and the expectation for 60 year old woman is that she will live 22.1 more years.[1] The proportion of elderly is growing, and infectious diseases can be considered a major health problem for this group, given that they account for one third of deaths. The proper management of infectious diseases such as urinary tract infection (UTI) is

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growing in clinical significance and in the healthcare costs to the geriatric population.[2,3]

UTI is considered to be the most common bacterial infection in community-dwelling elderly women and is associated with significant morbidity and mortality; there is mounting evidence that bacterial Gram-negative septic events in elderly institutionalized women are usually secondary to UTI. A significant bacteriuria has been found in approximately 20% of community-dwelling elderly women and in 10% of older men; this rate almost doubles after 80 years of age.[4] Several factors may contribute to the increased incidence of bacteriuria in elderly women, such as the decline of cognitive function, difficulty in walking, dementia and cerebrovascular accidents that hinder personal hygiene, functional and organic changes of the genitourinary tract, urinary and fecal incontinence, age-related immunodeficiency, hormonal changes, malnutrition, and diabetes.[4]

UTIs accounted for nearly seven million office visits and one million emergency department visits, resulting in 100,000 hospitalizations; most of these visits were by the elderly. Financially, the estimated annual cost of community-acquired UTI is significant, at approximately $1.6 billion.[5]

UTIs in the elderly frequently present with a range of atypical symptoms,[6] which delays diagnosis. When discovered, its management poses problems that may increase hospitalization and mortality. Therefore, the clinical suspicion of UTI in older people, by the general practitioner or specialist, is very important, so that diagnosis can be made. The aim of this study was to investigate the epidemiological and clinical characteristics of UTI in community-dwelling elderly women in order to make early diagnosis and prevent serious clinical complications secondary to UTI.

Material and methods

Study subjects

All women over 65 years of age who came to the first office visit with a general practitioner or nephrologist at the Hospital Universitário Gaffrée e Guinle and accepted to participate in the study, which was carried out from January 2008 to June 2010, were included. Before inclusion in the study, an informed consent was signed by all partcipants. This clinical research was conducted in accordance with the Declaration of Helsinki and approved by the local human research ethics committee as a sub-project of project number 59/2005. Patients with severe medical disability; conditions that might interfere with the ability to properly collect urine, such as a stroke or other neurologic diseases, dementia, and severe psychiatric diseases; and those with HIV infection or active cancer, were excluded from the study.

Study design

This descriptive, prospective, and longitudinal cohort study was conducted among 598 community-dwelling elderly women who went to medical consultation at the Hospital Universitário Gaffreé e Guinle. Their laboratory parameters, signs and symptoms of UTI were carefully assessed at baseline and during the six-month of follow-up.

Data collection and laboratory determinations

Medical records were obtained by clinical history and physical examination in order to detect signs and symptoms of UTI, history of previous UTIs, and presence of comorbidities that might predispose to UTI. All patients collected clean–catch midstream urine samples from the first urine of the day for urinary dipstick test, sediment, and culture. Cervical smears were collected for cervical cytologic study by conventional Pap smear.

Urine was collected one day after the first medical consultation for examination and culture. Urinalysis and microscopy were considered positive when positive leukocyte esterase and/or nitrite (assessed by urinary dipstick test in fresh urine) associated with a pyuria (≥ 10 leukocyte/hpf) from a centrifuged midstream urine sample by microscopy (x 400 magnification) were present. Significant bacteriuria (SB) was considered present when ≥ 100.000 colony-forming units (CFU)/mL were isolated in urine culture. In the patients with SB, the urine examination was repeated after one, three, and six months; and whenever necessary in patients who presented UTI.

UTI was defined by the presence of urinary symptoms associated with SB in urine culture. Asymptomatic bacteriuria (AB) was defined only when SB was detected in two consecutives urine cultures with seven days of interval; recurrent UTI was defined as two or more UTIs detected in a period of six months. Pyelonephritis was defined as urinary symptoms associated with SB, fever or abdominal pain, and elevation of laboratory inflammatory parameters, such as C-reactive protein and leukocytosis.

Statistical analysis

All statistical analyses were performed using SigmaPlot (Systat Software Inc.) software packages. Statistical procedures included analysis of mean and standard deviation for categorical and numerical data. Student's t-test was used for comparison between two groups. Bivariate comparisons of selected potential risk factors between groups were tested using chi-squared tests associated with Yates continuity correction for categorical variables. Odds ratio (OR) and 95% confidence intervals (CIs) were calculated using standard methods; a p-value < 0.05 was considered statistically significant.

Results

Clinical data of elderly women

A total of 598 women, mean age 71.93 ± 6,26 (range: 65 to 95) years old, were included in this study, and their medical records revealed a history of previous UTI in 85 (14.21%). 387 (64.71%) were sexually active; 119 had diabetes (19.89%) and 36 had urinary incontinence (6.02%). A high SB prevalence of

Table 1 – Clinical data of the community-dwelling elderly women.	
Number of women	598
Age (years)	71.93 ± 6.26
Significant bacteriuria	126 (21.07%)
Asymptomatic bacteriuria	27 (4.51%)
Urinary tract infection (UTI)	99 (16.55%)
Types urinary tract infection	
Cystitis	97 (97.97%)
Pyelonephritis	2 (2.02%)
Recurrent UTI	28 (28.28%)
Symptoms of UTI	
Foul smelling urine	60 (60.60%)
Dysuria	33 (33.33%)
Frequency	30 (30.30%)
Urgency	29 (29.29%)
Urinalysis and microscopy in UTI	
Sensitivity	84.84%
Specificity	81.56%
Positive predictive value	47.49%

21.06% in older women was observed (UTI in 99 [16.55%] and AB in 27 [4.51%]).

The main spontaneous urinary symptom found in the group with UTI was foul smelling urine in 60 (60.60%). It was the only symptom in 26 patients (26.26%), and was followed by dysuria in 33 (33.33%), frequent urination in 30 (30.30%), and urgency to urinate in 29 (29.29%). Cystitis was present in 97 patients, and pyelonephritis in two patients that had presented foul smelling urine two to three weeks before that was not considered as UTI symptom by the general practitioner; and 28 had had recurrent UTIs (28.28%) (Table 1).

Laboratorial data in the first collected urine

The presence of pyuria (≥ 10 leukocyte/hpf) associated with positive leukocyte esterase and/or nitrite test was observed in 84 patients (84.84%) with UTI, in 12 (44.44%) with AB, and in 82 (17.37%) without UTI. This demonstrated a sensitivity of 84.81%, specificity of 81.56%, positive predictive value of 47.19% for the UTI diagnosis (Table 2).

Urine culture showed that *Escherichia coli* (*E.coli*) was the most frequent pathogen and was responsible for 75 (75.75%) UTIs, followed by *Enterococcus* spp. in 9.09%, *Proteus mirabilis* in 6.06%, and *Klebsiela pneumonia* in 5.05%. *E. coli* was responsible for 23 (85.18%) cases of AB, followed by *Enterococcus* spp. in three (11.1%). The susceptibility of *E. coli* to the tested antibiotics showed that 24 strains (32.00%) in UTI and ten (42.47%) in AB were resistant to trimethoprim-sulfamethoxazole, and that 13 (17.33%) in UTI and eight (34.78%) in AB were resistant to fluoroquinolones (Table 2).

Predisponent factors for UTI emergence

The elderly women in this study who had UTI (age 77.96 ± 6.57 years) were older than those without UTI (age 71.33 ± 6.02 years), with a p-value < 0.001 (Table 3).

When factors that may predispose the emergence of UTI were studied, it was observed that the history of previous UTIs presented by 85 (14.21%) elderly women (46 [46.46%] with and 39 [7.81%] without UTI) increased UTI emergence risk (p < 0.001, OR = 10,237 [6,130 < OR < 17,096]). However, the presence of urinary incontinence that was observed in 36 (6.02%) of 598 elderly women (30 [6.01%] without and 6 [6.06%] with UTI) with the monthly mean rate of urine leaks of 2.33 ± 1.12 (from one to five times per month) did not increase UTI risk (p = 0.985, OR = 1,009 [0,408 < OR < 2,492]) (Table 3).

Sexual activity was reported by 387 (64.71%) women (69 [69.69%] with and 318 [63.72%] without UTI). They had regular sexual activity from one to three (2.49 ± 1.12) times per month, and that did not increase UTI risk (p = 0.307, OR = 1,309 [0,821 < OR < 2,086]). However, vaginitis significantly increased the risk for the emergence of UTI (p < 0.001, OR = 20,287 [8,936 < OR < 46,057 – in elderly women. Cervical cytological study was performed in 163 women (72 with and 91 without UTI) (Table 3) and showed the presence of vaginitis in 11 (12.08%) of 91 women without UTI (candidiasis in four diabetics and bacterial in seven), and in 53 (73.61%) of 72 with UTI (candidiasis in eight, diabetics and bacterial in 45) associated with hypotrophic smears in 100%. None of them were using estrogen replacement.

Diabetes was present in 119 (19.89%) women, and SB in 38 (31.93%), UTI in 28 (23.52%), and AB in ten (8.40%). When the prevalence of UTI and AB was compared between diabetic and non-diabetic older women (Table 3), it was observed that the presence of diabetes increased the risk of both UTI (p = 0.031, OR = 1,768 [1,080 < OR < 2,895]) and AB (p = 0.041, OR = 2.493 [1,111 < OR < 5,597]).

Treatment

In all of UTI patients, an empirical therapy was started after urine culture collection. Nitrofurantoin was used as oral therapy for seven days to treat cystitis; and intravenous amoxacilin-clavulanic acid followed by oral therapy was used for 14 days to treat pyelonephritis. In recurrent UTI, intravaginal estrogen replacement and prophylactic antibiotic therapy were used for prevention. AB was not treated, and only two non-diabetic women presented cystitis in the fourth and fifth months of the follow-up and received appropriate antibiotic therapy.

Discussion

UTI is one of the most common bacterial infections in women of all ages, but the incidence increases with older age. Almost half of all women have suffered from at least one episode of UTI sometime during their reproductive years, a percentage that increases to at least 60% in the postmenopausal years. Factors contributing to the higher incidence of UTI with age include urinary tract anomalies, changes in hormonal status, urinary incontinence, decline in the immune system, malnutrition, functional disability, and coexisting illnesses.[7]

In the present study a high prevalence of UTI was found: 16.55% (99 patients) of elderly women. UTI frequency was higher in the older women (p < 0.001), and showed an atypical clinical presentation, where the principal spontaneous urinary symptom was foul smelling urine in 60.60%, which was associated with the presence of vaginitis in 20 (33.33%)

Table 2 – Laboratory data of the first collected urine of 598 elderly women.

	Urinary tract infection	Asymptomatic bacteriuria	Without significant bacteriuria
Urinalysis positive			
≥ 10 leukocyte/hpf) + positive nitrite and/or leukocyte esterase test)	84 (84.84%) of 99	12 (44.44%) of 27	80 (16.94%) of 272
Urine culture			Negatives
Escherichia coli	75 (75.75%)	23 (85.18%)	
Enterococcus spp.	9 (9.09%)	3 (11.11%)	
Proteus mirabilis	6 (6.06%)	0 (0.0%)	
Klebsiela pneumonia	5 (5.05%)	1 (3.70%)	
Staphylococcus saprophyticus	3 (3.03%)	0 (0.0%)	
Citrobacter freundii	1 (1.01%)	0 (0.0%)	
E. coli resistance to antibiotic			
Trimethoprim-sulfamethoxazole	24 (32.0%) of 75	10 (42.47%) of 23	
Fluoroquinolones	13 (17.33%) of 75	8 (34.78%) of 23	

Table 3 – Risk factors for urinary tract infection (UTI) in the community-dwelling elderly women.

Clinical data	Total	With UTI	Without UTI	p
Number	598	99 (16.55%)	499 (83.44%)	
Age (years)	71.93 ± 6.26	77.96 ± 6.57	71.33 ± 6.02	p < 0.001
History of previous UTI	85 (14.21%)	46 (46.46%)	39 (7.81%)	p < 0.001
Diabetes	119 (19.89%)	28 (23.52%)	91 (18.23%)	p < 0.042
Urinary incontinence	36 (6.02%)	6 (6.06%)	30 (6.01)	p = 0.906
Sexual activity	387 (64.71%)	69 (69.69%)	318 (63.72%)	p = 0.308
Vaginitis	64	53 (53.53%)	11 (1.83%)	p < 0.001

patients, and none wore absorbent pads. Two of these patients in whom foul smelling urine was not considered a UTI symptom by the general practitioner developed ascending pyelonephritis. Thus, spontaneous symptoms such as foul smelling urine, especially in elderly women without vaginitis and who do not use absorbent pads, must be considered as a UTI symptom.

UTI symptoms are the most important factors to the diagnosis; urinary dipstick test does not increase the likelihood of UTI diagnosis and may delay treatment.[8] Physicians must be aware of the atypical symptoms because when a UTI symptom is not recognized, treatment is delayed and the impact that an apparently trivial illness such as UTI has on the elderly patient increases, accounting significantly for increased mortality and health care costs, and decreased quality of life.[8]

Several factors have been associated with increased risk of UTIs in elderly women, including urinary incontinence, a common and embarrassing problem that has a profound effect on social and psychological well-being. Many people wear absorbent products to contain urine leakage and protect their clothes. It can be difficult to define light urinary incontinence because urine volumes, flow, and frequency rates may vary substantially whilst still being considered 'light'. Light incontinence may encompass occasional (monthly) leaks of very small amounts (e.g. 1 g to 2 g) up to larger amounts (e.g. 20 g to 50 g).[9]

Light urinary incontinence was observed in 6.02% of the older women group, with occasional monthly leaks, mean rate of urine loss of 2.33 ± 1.12 times per month, and did not prove to be a UTI risk factor in these women. However, it has been demonstrated that incontinence alone, with a higher frequency, remained a significant risk factor for UTI. The monthly mean rate of urine loss was 2.64 times per month among women who did not experience a UTI compared with 4.60

times per month among women who developed a UTI; the amount of urine lost was no longer independently associated with UTI risk.[9]

Sexual activity is an accepted risk factor for UTI in young women and continues to be a significant, albeit less important, risk factor in elderly women. The prevalence of sexual activity declined with age, from nearly 73% among 57 to 64 years of age, 53% from 65 to 74 years, and 26% from 75 to 85 years.[10] In our study, the patients had little regular sexual activity (from one to three times per month) and that did not increase UTI risk. It has been demonstrated that only women who reported sexual activity once or more per week were at increased risk.[7]

However, sexual activity was increasing in the elderly women group, and approximately half of them reported at least one bothersome sexual problem directly related to the hormonal changes secondary to menopause that can facilitate the development of vaginitis. Women with vaginitis are at increased risk for UTIs[11] as was also demonstrated in this study, and it is very important that elderly women should be educated about the need for routine gynecologic examinations in order to prevent UTI.

Diabetic elderly women are thought to be at increased risk for UTI and AB, presumably due to immunological and metabolic changes associated to neurological abnormalities secondary to diabetes.[12] Glucosuria and the increased formation of advanced glycosylation end products may play a role in the development of diabetic complications and may also contribute to the development of UTI, because these factors can lead to disturbances in monocyte migration and cytokine production.[13–15] In this study, the prevalence of AB and UTI was also higher in diabetic women, and they had similar isolated microorganisms, clinical follow-up, and therapy response to non-diabetic women.

Almost all epidemiological studies on UTI have shown that *E. coli* is the most frequent infective pathogen in both younger and older women.[16] In this study, *E. coli* was responsible for 75.75% of UTIs, and 85.18% of ABs, and showed a high resistance to trimethoprim-sulfamethoxazole and to fluoroquinolones, mainly in AB, probably due to the frequent use of unnecessary antibiotic therapy for AB. Antimicrobial resistance among uropathogens causing community-acquired UTI is increasing due to the current drugs of choice for cystitis treatment in elderly women.[17]

Community-acquired UTI therapy usually begins before the results of microbiological tests are known. Furthermore, in women with acute uncomplicated cystitis, empirical therapy without a pre-therapy urine culture is often used. The choice of the antimicrobial for elderly patients is complicated by the many physiological and environmental conditions associated with older age. The rationale for this approach must be based on the highly predictable spectrum of etiologic agents causing UTI, the use of antibiotics in the preceding months, the antimicrobial resistance in the local community, and the pre-therapy urine culture.[18–20] When empirical therapy is used, it should be reassessed 48 to 72 hours after initiation, once pre-therapy culture is available. Assessment of therapeutic response to antibiotic therapy is important, since UTI in older patients is usually complicated.

Some studies have demonstrated that uncomplicated cystitis in elderly women may be treated with a short course (3 to 6 days) of antibiotic therapy.[21] However, it's very difficult to determine what is uncomplicated UTI in elderly women, thus all patients in this study were treated for seven days for cystitis and 14 days for pyelonephritis. An empirical therapy began after urine culture collection, based on the susceptibility of *E. coli* to the antibiotics in outpatients of this hospital[22] and, when necessary, it was changed to an appropriate antibiotic based on the susceptibility testing of the urine culture. Control of the underlying diseases is quite important in the management of UTI in elderly patients. In all cases, antibiotics must be carefully adapted to the patient's situation and titrated to kidney function.

For recurrent UTI prophylaxis, intravaginal estrogen replacement and prophylactic antibiotic treatment are prescribed. Postmenopause reflects a decrease in circulating estrogen and a related decrease in lactobacilli colonization associated with lower vaginal pH. Consequently, vaginal colonization with possible gastrointestinal uropathogenic bacteria increases, which may partially account for the generally higher incidence of bacteriuria in elderly women. Intravaginal estrogen replacement may be the treatment of choice for the prevention of recurrent UTI in postmenopausal women.[23]

High fluid intake (more than one liter of water/day) and frequent voiding (voiding at a three to four-hour intervals) to maintain bacterial clearance throughout the day, associated with the habit of voiding after coitus and at bedtime, are measures that should always be implemented in order to reduce the number of UTI episodes.

In this study, AB was not treated and did not increase morbidity in elderly women. Treatment for AB is not justified and will often present opportunities for the infecting organism to acquire antimicrobial resistance. Screening for AB in elderly patients is limited to those undergoing invasive urological procedures and surgical procedures with implant material. In other situations, examination of the urine is not recommended if signs or symptoms in the urinary tract are absent. Treatment of AB is only recommended in pregnancy and before urological procedures.[24]

The present study has some limitations: (i) subjects were recruited from a tertiary medical care hospital; (ii) potential for laboratory exam selection bias because of the decision to exclude patients with severe medical disabilities, conditions that might interfere with the ability to properly collect urine, which are generally associated to a higher urinary incontinence and continuous absorbent pad use. Therefore, the prevalence of UTI in community-dwelling elderly women may have been underestimated. (iii) small UTI and AB sample size, and short follow-up.

UTI remains one of the most frequent infections among community-dwelling elderly women, generally associated with nonspecific symptoms. Thus, the clinical suspicion of UTI is very important for prompt recognition and treatment, to prevent clinical complications, and to decrease hospitalization and mortality. It is necessary to implement simple measures such as increased fluid intake and voiding, and routine gynecologic examinations, in order to reduce UTI episodes and treat the comorbidities that predispose to UTI emergence. Physicians must know that examination of the urine is only recommended if UTI is suspected. When performed indiscriminately, it brings serious problems and leads to hasty and unnecessary indication of antibiotic therapy. Treatment for AB is not justified and will often present opportunities for the infecting organism to acquire antimicrobial resistance, especially in elderly patients.

Conflict of interest

All authors declare to have no conflict of interest.

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